Test Procedure for

TESTING POLYMER CONCRETE

TxDOT Designation: Tex-618-J

Effective Date: January 2009

1. SCOPE

1.1 The method includes procedures for preparing and testing polymer concrete specimens as specified under DMS-6140. Perform tests on binder components alone, and on the complete mixture of binder and aggregate. Refer to DMS-6140 for a description of the two types of polymer concrete and the tests performed on each type.

1.2 Tests on polymer binder only:

- tensile strength and
- ultimate elongation.

1.3 Tests on complete polymer concrete:

- wet bond strength to concrete,
- 24-hour compressive strength,
- compressive stress, and
- resilience.

1.4 The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.

2. PREPARING SAMPLES

2.1 Allow material to stabilize at a temperature of 77 ± 4°F (25 ± 2°C). Measure components in the ratios specified by the producer. Convert volume ratios to weight ratios using the gallon weight of the components.

2.2 Thoroughly mix the components. For tests that use aggregate, make sure the aggregate is mixed well with the binder.

2.3 Use Teflon or lubricant-coated metal as mold surface.

2.4 Pour binder mixtures into molds as soon as possible after thorough mixing.

Note 1—To minimize entrained air during mixing, use physical means or pass a soft flame over the surface.

2.5 Allow specimens to cure sufficiently to prevent damage caused during removal from molds.

3. TENSILE STRENGTH

3.1 *Apparatus:*

3.1.1 *Tensile specimen mold,* conforming to ASTM D 638, Type IV, with dimension width overall (WO) of 1 in. (25 mm).

3.1.2 *Dial gauge or caliper.*

3.1.3 *Tensile testing machine,* constant-rate-of-extension (CRE) type, with automatic recording, conforming to the requirements of ASTM D 76.

3.1.4 *Testing clamps,* with 1 × 2-in. (25 × 50-mm) serrated jaws, and appropriate clamping power to prevent slipping or crushing.

3.2 *Procedure:*

3.2.1 Using the weight ratios, measure a sufficient amount of the binder components to fill the mold. Thoroughly mix the components, and pour into the mold. Cast at least three specimens. Remove any entrained air using a soft flame or physical methods.

3.2.2 After 7 days of curing at 77 ± 4°F (25 ± 2°C), carefully remove the specimen from the mold. Remove excess material and smooth the edges.

3.2.3 Measure the thickness and width of the specimen neck with a dial gauge or caliper and determine the cross-sectional area.

3.2.4 Use an initial tensile test machine jaw separation of 2 in. (51 mm) and a crosshead speed of 2 in. (51 mm) per minute. Calibrate and set an extensiometer on the sample with an initial gage length of 1 in. (25 mm).

3.2.5 Load the specimen to failure and use the maximum load to determine the tensile strength.

3.2.6 Report the average results from the three specimens in psi (MPa). Discard any with obvious flaws.

4. ULTIMATE ELONGATION

4.1 Perform this test according to the methods of Section 3 using the same specimens.

4.2 Determine ultimate elongation from initial gage length and the final amount of extension at failure.

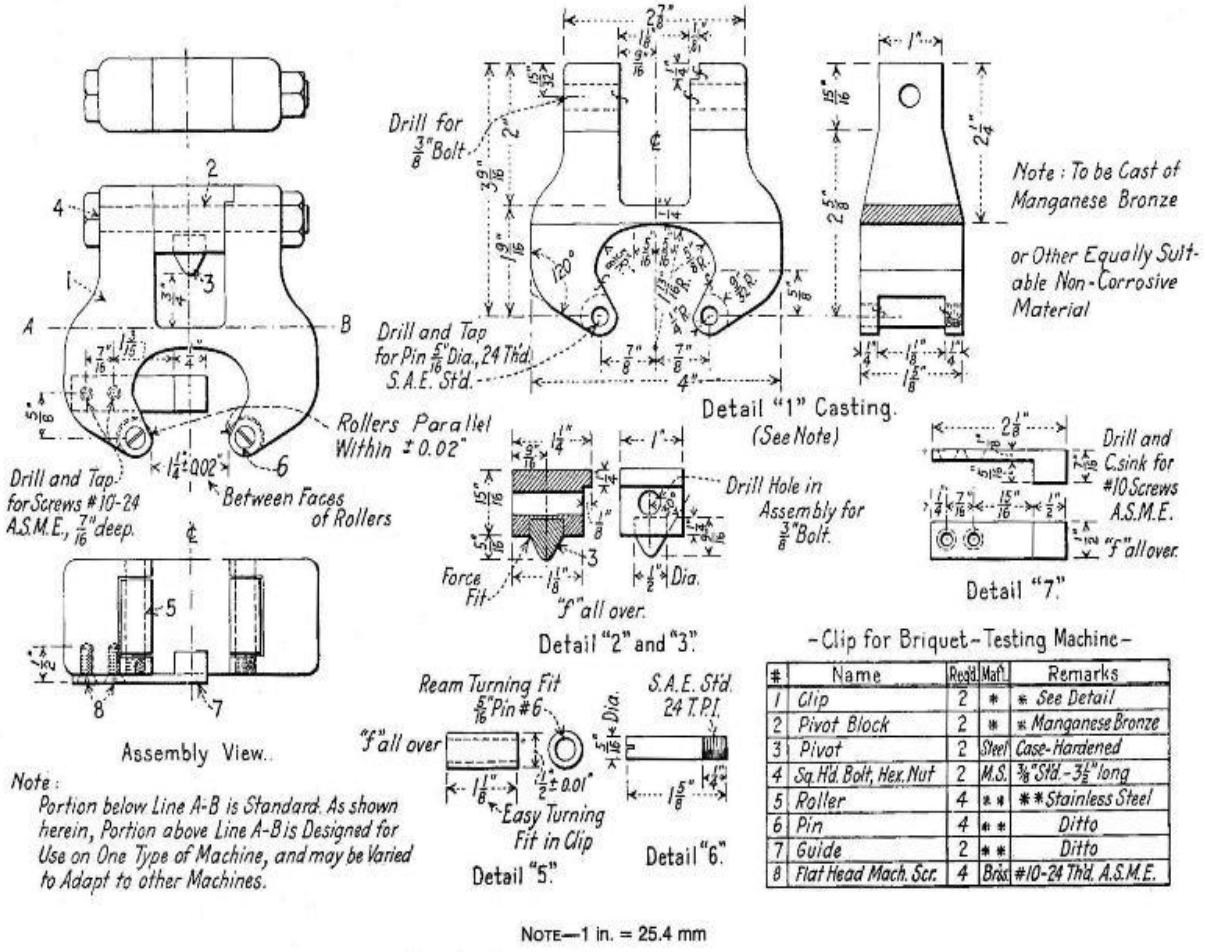
4.3 Calculate the ultimate elongation as a percent of the original gage length.

4.4 Report the average result from the three specimens.

5. WET BOND STRENGTH TO CONCRETE

5.1 *Apparatus:*

5.1.1 *Testing machine,* capable of maintaining a constant rate of travel of 0.05 in./min. (1.3 mm/min.) and applying a tensile force of at least 500 lbf. (2.2 kN). Use grips as shown in Figure 1 to hold specimens.



#	Name	Reqd.	Mat'l.	Remarks
1	Clip	2	*	* See Detail
2	Pivot Block	2	*	* Manganese Bronze
3	Pivot	2	Steel	Case-Hardened
4	Sq. Hd. Bolt, Hex. Nut	2	M.S.	3/8" Std. - 3 1/2" long
5	Roller	4	* *	* * Stainless Steel
6	Pin	4	* *	Ditto
7	Guide	2	* *	Ditto
8	Flat Head Mach. Scr.	4	Brass	#10-24 Thd. A.S.M.E.

Figure 1 —Grips for Constant Rate of Crosshead Movement Testing Machine

5.1.2 *Briquette mold,* of the type shown in Figure 2. The waistline of each briquette must be 1 ± 0.02 in. (25 ± 0.5 mm), and the thickness of the molds must be 1 ± 0.02 in. (25 ± 0.5 mm).

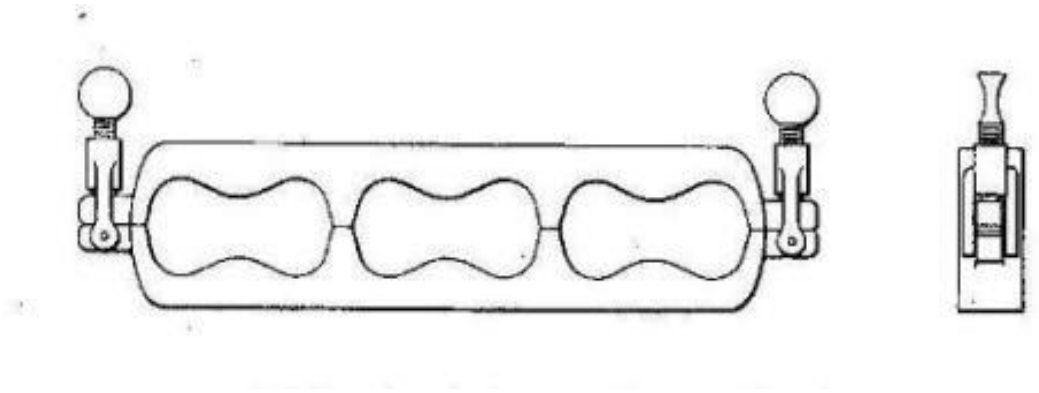


Figure 2 —Briquette Mold

5.1.3 *Water bath*, capable of maintaining 77°F (25°C).

5.2 *Procedure:*

5.2.1 For wet bond strength to concrete test, obtain mortar briquette halves prepared in accordance with Tex-614-J, Section 8.2.2. Sandblast the bonding face of each mortar briquette. Clean the bonding faces of the briquettes with compressed air.

Note 2—Do not touch bonding faces after sandblasting.

5.2.2 Place a briquette half in the mold. If recommended by the manufacturer, apply primer to the surface of the briquette.

5.2.3 Ensure that the initial temperature of each component is 77 ± 2°F (25 ± 1°C). Using the weight ratios, measure sufficient binder and aggregate to fill the three briquette halves. Thoroughly mix the three components. Fill the other half of the briquette molds with complete polymer concrete. Make at least three specimens.

5.2.4 Cure briquettes for 5 days in air at 77 ± 4°F (25 ± 2°C).

5.2.5 Immerse the specimens in 77 ± 4°F (25 ± 2°C) water for 2 days in a horizontal position.

5.2.6 Remove the specimens from the water, blot dry, and subject them to tensile loading while still damp.

5.2.7 Start up, balance, and calibrate the tensile machine according to the manufacturer's instructions. Place the grips on the machine. Set the crosshead speed to 0.05 in./min. (1.3 mm/min.)

5.2.8 Load a specimen into the tensile machine. Start the testing machine and load until break. Record the load at break. Repeat the test for the remaining specimen.

5.2.9 Determine the average tensile breaking stress based on a 1-in.^{2} (25-mm^2) cross-sectional area. Record the average of the three specimens in psi (MPa).

6. 24-HOUR COMPRESSIVE STRENGTH

6.1 Perform test as described in ASTM C 579.

6.2 Form three specimens and cure for 24 hours at 77 ± 4°F (25 ± 2°C).

6.3 Compress samples in a compression machine, and measure the maximum load.

6.4 Calculate stress from max load and report the average of the three specimens in psi (MPa).

7. COMPRESSIVE STRESS

7.1 *Apparatus:*

7.1.1 *Compression testing machine*, capable of a constant rate of crosshead movement of 0.15 in./min. (4 mm/min.) and capable of applying a maximum load of at least 20,000 lbf. (100 kN). Use compression plates that are flat and parallel to each other in a plane normal to the vertical loading axis.

7.1.2 *Molds*, to cast 2-in. (50-mm) cubes. The interior surfaces of the mold must be planar and conform to the following tolerances: height 2 in. + 0.01 in. to - 0.015 in. (50 mm + 0.25 mm to - 0.38mm), distance between opposite sides 2 in. ± 0.02 in (50 mm ± 0.5mm), angle between adjacent faces 90° ± 0.5°.

7.1.3 *Dial gauge or calipers.*

7.2 *Procedure:*

7.2.1 Obtain molds to cast three 2-in. (50-mm) cubes. Line the inside of the molds with release grease.

7.2.2 Using the weight mixing ratios, measure sufficient binder and aggregate material to fill the three cubes. Thoroughly mix the components together.

7.2.3 Pour the mixture into the molds in two lifts and tamp the material after each lift. Screed off any excess material on top of the blocks. Cure specimen for 7 days at 77 ± 4°F (25 ± 2°C).

7.2.4 Using a dial gauge or caliper, determine the original height of the specimen within 0.001 in (0.03 mm) without a load.

7.2.5 Place the specimen in the compression machine, zero the dial gauge, and apply a 100-lb. (445-N) preload.

7.2.6 Load the specimen at a rate of 0.15 in./min. (4 mm/min.) until reaching deflection of 0.10 in. (2.5 mm). Record load at 0.10 in. (2.5 mm).

7.2.7 Calculate the compressive stress based on the original 4-in.^{2} (2580-mm^2) area. Report the average of the three specimens in psi (MPa).

8. RESILIENCE

8.1 The resilience test is a continuation of Section 7.

8.2 After removal of the load, allow the specimen to recover for 5 minutes.

8.3 Re-measure the height, and calculate the resilience as a percentage of recovered height:

$$Resilience = \frac{s + f - i}{s}$$

Where:

s = max displacement of crosshead (0.1 in. or 2.5 mm)

f = final height of cube

i = initial height of cube.

8.4 Report the average of the three specimens.

9. ARCHIVED VERSIONS

9.1 Archived versions are available.